

2016 HOLSUM DAIRIES GREEN TIER ANNUAL REPORT TO WDNR

*Partners in
Agriculture*

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Dairy Manager's Annual Report of Holsum Dairy's Eleventh Year of Green Tier Qualification

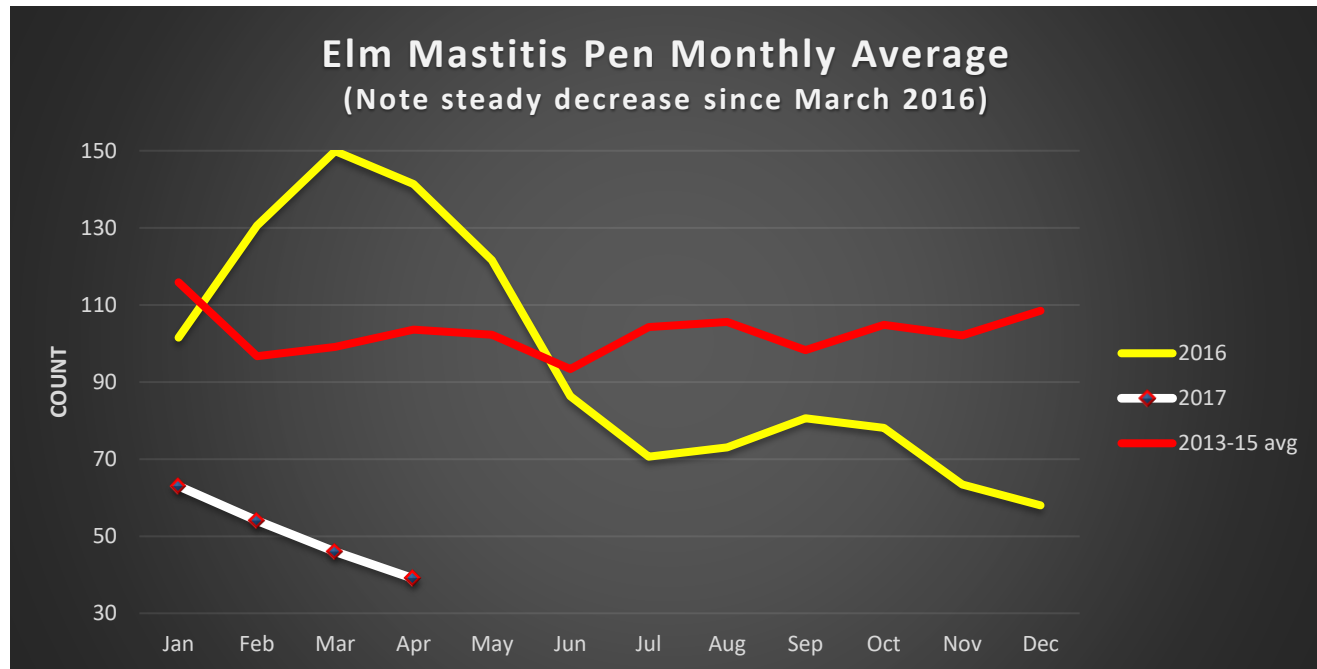
Each year, with our focus on environmental responsibility, we alter/change/improve numerous processes/procedures, too many to make good reading here. So, this year I'd like to focus on three major endeavors: upgrading liquid manure lagoons, reducing soil erosion using a cover crop, and showing benefits of our bedding dryer via an indirect measure: antibiotic usage.

In the Fall of 2015 when the lagoons were emptied, we detected some areas of the clay walls that had fallen into the lagoon. Our consulting Professional Engineer determined that the surrounding soil, soaked by heavy rains, had pressured the lagoon walls in a few areas. Investigation revealed crushed drain tiles placed too deeply were partially to blame. Our walls had been constructed at twice the required thickness, by our choice, so containment was never breached. Not wanting to ever have a significant manure contamination event, we budgeted for repairs in 2016. We had the experience of concreting the walls of a temporary lagoon, and decided to remove the wet clay, rebuild the clay walls, and then to concrete all 3 of Elm's manure ponds (2 in 2016, 1 in 2017). We are now as confident as one can be that we have done all in our power to prevent any leakage from our holding ponds.

Preventing soil erosion is a universal problem for farms; best solutions include a cover crop over winter to reduce soil loss. Solutions can appear expensive. A cover crop does not directly return what it costs to plant. Nevertheless, we planted 150 acres. Many freeze-thaw cycles in the unusually rainy winter killed ~40% of the field. Since 60% flourished, the idea lives on and we plan to seed more acres in 2017.

Finally, the bedding dryer. Some background: Mastitis infections are the bane of any dairy. Production is lost, antibiotics are necessary treatments. We have adhered to many "best practices" to prevent mastitis, which has kept our milk at very good quality. But our intense management and hygiene efforts just could not lower the occurrence of mastitis below industry averages.

An (expensive) bedding dryer was the final step, its high cost notwithstanding. Its first iteration, undependable and hazardous, was tried from 2013-15 and eventually taken down and sold. After construction of the present equipment and its building, there was still the fine tuning to do. In June 2016, the fine tuning led to reliable quantities of dried manure solids, enough to allow both Irish and Elm to bed their cows consistently. Environmental mastitis rates plunged in the next few months, taking antibiotic use down with them. And we have diverted 2 full-time employees away from the hospitals as a result!



Robert Nagel, DVM, MS
Manager, Holsum Dairies, Hilbert, Wisconsin 54129

PS: Less momentous, but definitely significant activities during 2016: verified efficacy of silage leachate systems, interacted with individuals and groups in the community, hosted a DATCP Spanish Outreach event, purchased an energy saving Triolet feed mixer, continued providing free manure solids to local gardeners twice yearly, found a business that takes our voluminous silage pile agricultural plastic for recycling, survived a milking parlor fire without human or animal casualties, and welcomed local, state, and international visitors to tour our facility.

Summary of digesters' effect on the local community:

Briess Industries, a local Green Tier member, is our largest off site by-product contributor.** Irish Dairy accepted into its digesters **3,814,738 gallons** of 'waste' from area businesses. Elm Dairy accepted into its digesters **6,749,973 gallons** of 'waste' from area businesses.

ELECTRICITY FROM MICROBES	2012	2013	2014	2015	2016
Liquid 'waste' kept out of sewage treatment plants (gallons):	12,163,162	12,107,756	11,567,865	12,832,572	10,564,711

** Others include local restaurants, a school, KayTee Products, two long term care facilities and Foremost Farms USA.

2016 Holsum Dairy Objectives and Targets

Continuous Objectives

Objective 1 (regulatory): Continue practice of reducing the amount of rain and snow water that mixes with manure related liquids.

Target 1: Monitor water flow and accumulation points; verify operation of new silage leachate system.

Objective 2: Continue our outreach to interested groups as providers of information and as recipients of constructive criticism.

Target 1: Consider any invitations to speak to industry groups or concerned citizens.

Objective 3: Aid our community in reducing its waste stream and document our conversations.

Target 1: Partner with local industry to accept approved byproducts of their operations into our anaerobic digesters, thus reducing what goes for sewage.

Target 2: Create and maintain a record of significant external communications currently made by managers and Environment and Safety coordinator. Routine calls need not be reported because they would require too much effort for low probability environmental impacts.

Objective 4 (reduce waste): Continue outreach to find approved alternative to disposal of LDPE and other agricultural plastics. Research any new recycling initiatives.

Target 1: Establish working relationship with any new business that arises from 2015's trial recycling of ag plastic in conjunction with University of Wisconsin Extension.

Note:

Dairy industry experts estimate that approximately 15-20 pounds of all types of ag plastics a year are used per cow.

In spring 2015, the DNR, UW-Extension and Organic Valley contracted with the UW-River Falls Survey Research Center to conduct a survey.

The report estimated that Wisconsin dairy operations may generate as much as 20.4 million pounds of recyclable plastic wrap each year.

Continuous Objectives (continued)

Objective 5: Stakeholder outreach

Target 1: Learn the basics of maintaining a FaceBook page. Take charge and improve FaceBook page that has been automatically generated as a food business/restaurant.

4.7.16 Wisconsin Milk Marketing Board and Professional Dairy Producers of Wisconsin's Facebook seminar for members in Green Bay; presenters urged greater communication with stakeholders and had each participant set up a Facebook page for the farm.

Target 2: Provide our Single Point of Contact (WDNR) with more contemporaneous messages about our Green Tier related activities.

Ad hoc project(s)

Objective 6: Obtain different style bedding dryer. The machinery needs to be safer, more automated, and more reliable.

Target 1: Arrange natural gas service to the farm to minimize propane usage.

Target 2: Measure bedding related mastitis cases before and after the dryer, with the desired outcome to be a noticeable decrease in clinical cases and antibiotic use.

2017 Holsum Dairy Objectives and Targets

Objective 1 (reduce our carbon footprint): Reduce trucking of manure by increasing underground manure piping 12,000 miles of semi-truck hauling annually.

Target 1: Reduce 2016 hauling miles by 12,000

Objective 2: (minimize the dairies' impact on the environment) Decrease hydrogen sulfide emissions from Irish Dairy's anaerobic digester generators.

Target 1: Reduce H₂S emissions by 90%.

Objective 3 (reduce energy consumption): Reduce energy consumption in the milking parlor facilities.

Target 1: Reduce energy use by lowering the number of cow cooling fans and increasing their efficiency at the Irish Dairy parlor. Replace **28** 1.5 horsepower fans with **13** 1.5 hp fans, reducing electrical use by a calculated 54%.

Target 2: Reduce energy use in both parlors by replacing metal halide fixtures with Light Emitting Diode (LED) fixtures in the 24/7 milking parlor

Objective 4: (conserve erodible soil)

Target 1: Incorporate cover crops on 20% of owned crop land

HISTORICAL SUPPORTING DATA

Regulated topics:

Manure Metrics

Manure composition is of interest to us for our Nutrient Management Plan (NMP), as well as for minimizing our environmental footprint. After capturing the energy and fibrous material from cow “waste”, we have effluent with 82% less dry matter, 32% less nitrogen, 75% less phosphorous pentoxide (44% phosphorus), and 49% less potassium oxide (83% potassium) when compared to undigested manure values.

Weather changes kept us on our toes!

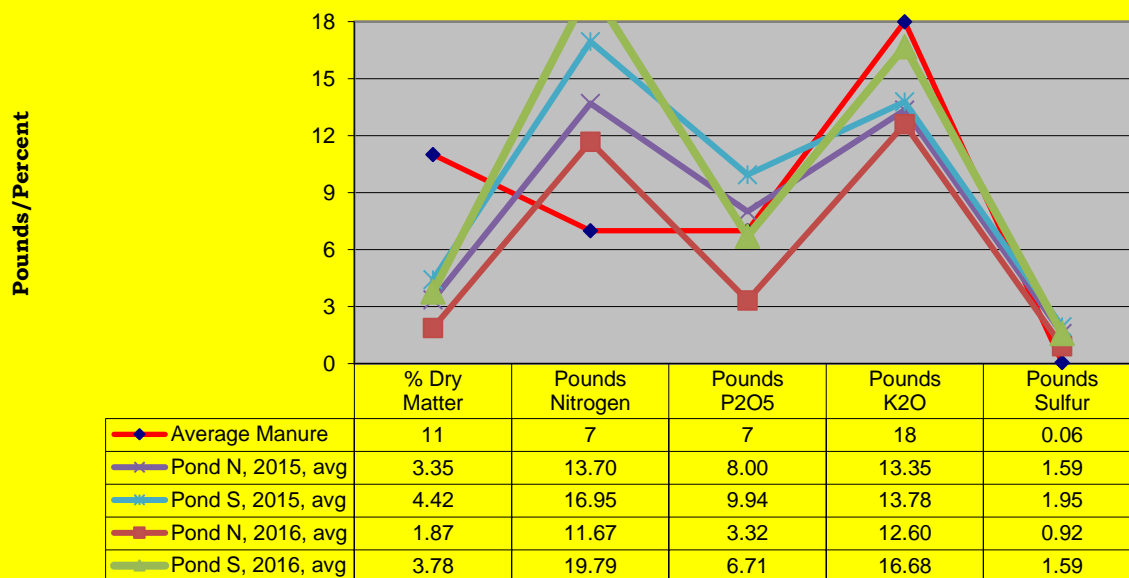
Rain and fog delayed timely lagoon emptying, but our own crew’s diligence allowed complete emptying of Elm Dairy’s lagoons.

Because of the wet fall, we are once more reporting “Transfer” as one method of judiciously returning manure nutrients to the land. “Transfer” means that lagoon contents are trucked to a pit or a holding tank near a field; they are then land applied via drag hose pulled by a tractor.

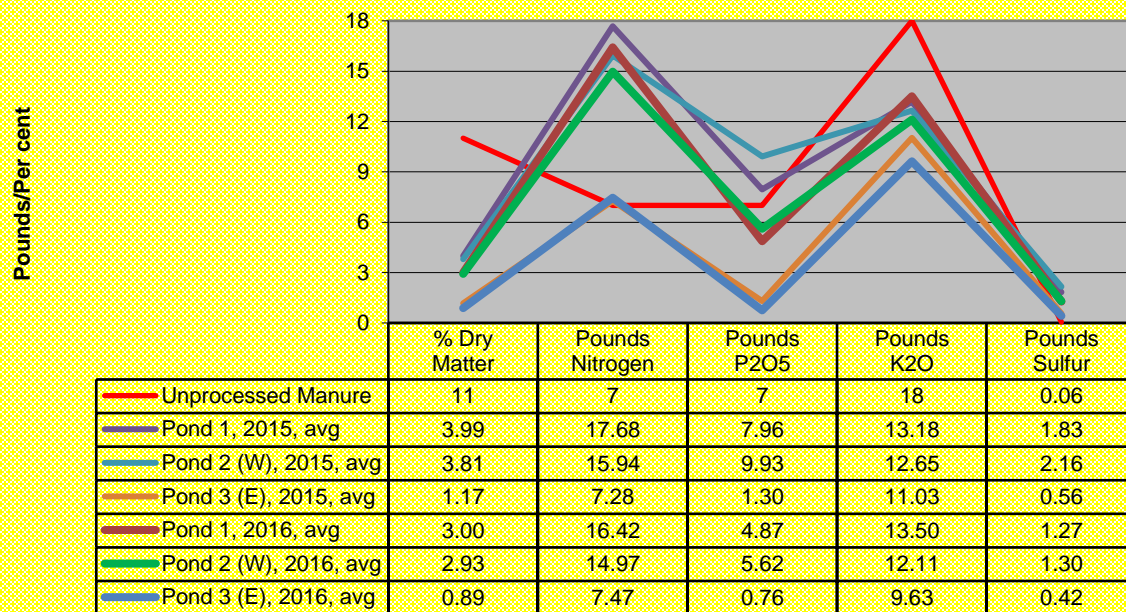
2012 gallons applied	124,471,833	(Irish and Elm Dairies and Calf Ranch young stock)
2013 gallons applied	130,322,433	(Irish and Elm Dairies and Calf Ranch young stock)
2014 gallons applied	120,554,066	(Irish and Elm Dairies and Calf Ranch young stock)
2015 gallons applied	170,958,120	(Irish and Elm Dairies and Calf Ranch young stock)
2016 gallons applied	165,247,727	(Irish and Elm Dairies and Calf Ranch young stock)

	Total gallons	Irish total gallons	Irish transfer	Irish % hosed	Elm total gallons	Elm transfer	Elm % hosed	Total % transfer	Total % hosed
2012	124,471,833	53,970,688	-	93.9%	70,501,145	-	63.7%	-	76.8%
2013	130,322,433	49,364,616	7,910,114	73%	80,957,817	32,986,767	35%	32%	49.5%
2014	120,554,066	59,786,819	23,159,046	58%	60,767,247	30,845,262	27%	45%	42%
2015	170,958,120	72,823,698	36,364,438	49%	98,134,422	52,006,930	29%	52%	37%
2016	165,247,979	66,481,727	34,972,125	48%	98,767,252	66,602,787	33%	54%	39%

Manure Analysis, Holsum Irish Dairy, 2 recent years



Manure Analysis, Holsum Elm Dairy, recent 2 years



The significance of the digested manure numbers in the previous graphs is:

- Less phosphorus builds up in the soil; it no longer is available to run into streams and contribute to algae bloom.
- We provide phosphorus, potassium (potash) and water to the alfalfa crop. By applying the effluent when the soil is relatively dry and the plant is actively growing, we reduce the likelihood of phosphorus leaching through the root zone. We reduce the purchase, transport and additional application of fertilizer.

Water usage

"When the well's dry, we know the worth of water."
—Benjamin Franklin

We are tracking our water usage from each well at each farm, as required by statute (Wisconsin Pollutant Discharge Elimination System, or WPDES). In addition, to allow for retrospective data mining and managing, we are comparing it to the numbers of cows (milking and dry) and the amount of milk shipped from the dairies. Increased water usage in hot months is primarily for cow cooling. **Water conservation measures have been emphasized since 2003.**

University of Wisconsin Extension has reported an average of 40-45 gallons per day per cow for the average dairy farm, in the average year. This includes not only the water they drink, but all water used to wash facilities, milk storage tanks, milking machines, and water to cool the milk and the cows.

For **2016**, our **Irish Dairy averaged 40.3** gallons per milking cow per day; **Elm Dairy averaged 54** gallons/milking cow/day... which includes water used to care for an additional 2300 calves and heifers (the result of an efficient artificial insemination breeding program).

Both dairies have repeatedly modernized cow cooling, meaning that even more water goes to cool the herd. It is the right thing to do for the cows, and it will continue as a "win-win" with more stable milk production during hot, humid weather.

What about people's households?

**All Things Considered,
National Public Radio,
5/13/15:**

The mayor of Santa Fe, New Mexico spoke about the results of the city's two tiered water fees. Prior to initiating the fees, Santa Fe averaged 162 gallons water per person per day. After the fees were in place, use dropped to 96 gallons per person per day. (Wisconsin residents average only 56 gallons per person per day)

2016 External Green Tier Audit

Auditors: Perfect Environmental Performance, LLC, of Cottage Grove, Wisconsin

Summary: The auditors conducted the on-site audit September 6, 2016 after auditing all documentation. They questioned employees, audited random protocols and procedures, and found some Opportunities for Improvement in these areas:

Recommendations for adoption/consideration:

- 1- Revamp the External Communications with interested parties, and document the new procedure.
- 2- "Communication in general appeared to be the Achilles Tendon of the EMS."
 - a. Recommended more communication between COO and EMS representative.
 - b. Aim for 100% documentation of non-conformities and corrective actions, including 'near misses'.
- 3- Revise relevant documents pertaining to the recommendations from the auditors, as the changes are made

To avoid duplicative recordkeeping, this page also serves as documentation of management's notice and acceptance of the External Audit.

Summation of Corrected Environmental Errors at Holsum Dairies, 2012-2016:

Liquid manure spills, chronological order	Severity	Brief Summary
June 13, 2012	3	Dry, cracked ground allowed manure to flow directly to tiles
November 2, 2012	3	Nighttime; monitoring procedure incompletely implemented
February 13, 2013	2	Failed clamp in zero-degree weather during snow event
November 5, 2014	3	Worker connected to wrong hose
February 5, 2015	2	Mice chewed pump wiring; late night fix misdirected flow
August 29, 2016	0	Driver spill error due to overgrowth concealing culvert end

Severity Codes:

- 0 == no impact on surface or ground water
- 1==reached adjacent on-dairy dry containment ditch or stormwater retention pond
- 2==reached sediment retention pond(s)
- 3== reached surface water (ditch, stream/pond/lake)
- 4==impacted ground water

By comparison, the Milwaukee Journal Sentinel, November 30, 2006, reported that "since 1994, Milwaukee Metropolitan Sewage District has dumped an average of more than 1 billion gallons of untreated sewage per year into Lake Michigan." **(2016 update:** average of 60 events/year is down to 2 events per year.)

This reference is included for perspective on the often sensationalized agricultural contribution to environmental pollution. Holsum Dairies, LLC remains committed to bettering its environmental performance. And we encourage all progress made by the Milwaukee Metropolitan Sewage District and other current Great Lakes polluters.

Unregulated topics:

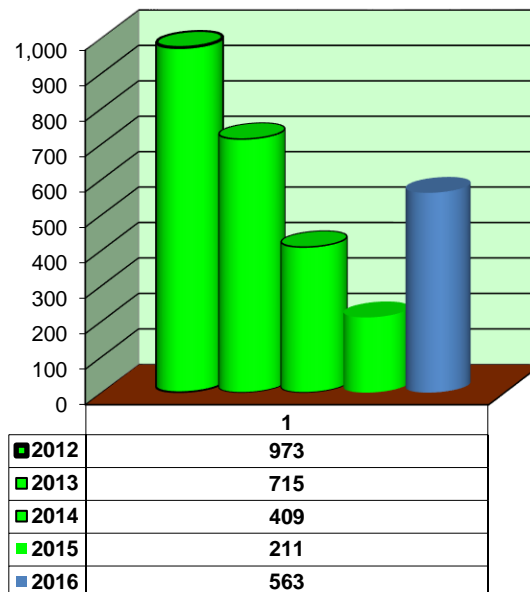
1-Energy Producing Manure Digesters: Below is a record of our operations' electric use and our digesters' production, with a chart (of the most recent five years) showing the numbers of Wisconsin homes (average use) that our excess power can supply.

Kilowatt Hours "Excess" data: Note: a negative number or an unusually low number in an 'Excess' box indicates a period during which mechanical/electrical problems were significant.

Year	Irish Gen, kwh	Irish Use, kwh	Irish Excess, kwh	Elm Gen, kwh	Elm Use, kwh	Elm Excess, kwh	Combined Excess, kwh	Avg. Home Equivalents, WPS data
2012	5,746,992	2,616,331	3,130,661	7,790,214	3,563,801	4,226,413	7,357,074	973
2013	4,133,444	2,437,891	1,695,553	7,233,193	3,526,432	3,706,761	5,402,314	715
2014	3,968,949	2,536,867	1,432,082	5,281,854	3,618,133	1,663,721	3,095,803	409
2015	3,635,546	2,768,649	866,897	4,539,541	3,809,243	730,298	1,597,195	211
2016	3,860,893	2,722,014	1,138,879	7,389,427	4,274,624	3,114,803	4,253,682	563

Note: In 2010, and again in 2015, the Elm digester was rebuilt. In 2011, we rebuilt the Irish digester. The investment, at an approximate cost of \$200,000, created higher generator reliability and a record amount of saleable kWh. As a result, in 2012 and 2013, the dairies far exceeded previous electrical generation from 'waste'.

Holsum's Green Electrical Energy Results



2-Fossil Fuel Usage in gallons and therms, 2016 parameters:

Liquid Fuel, gallons	2016
Diesel, Irish, total	84,714
Diesel, Elm, total	141,758
Diesel, direct, Feed Harvest	60,224
--Corral Cleaning, Irish	30,319
--Corral Cleaning , Elm	53,655
--Farm Diesel, Irish	53,485
--Farm Diesel, Elm	61,798
--Fuel Oil, Irish	910
--Fuel Oil, Elm	26,306
Gasoline, Irish	5,458
Gasoline, Elm	10,458
Propane, Irish	0
Propane, Elm	61
Nat'l Gas, therms	2016
Natural Gas, Irish, total	21,161
Natural Gas, Elm, total	223,799
--Digester, Irish	973
--Digester, Elm	26,306
--Parlor, Irish	20,187
--Bedding Dryer, Elm	197,493
Carbon dioxide equivalent, metric tons	4351

Transportation and Vehicles

Transportation makes up a large part of an organization's overall environmental footprint. After it is cooled, our milk is deposited directly into insulated stainless steel tankers and picked up at the farm by a trucking business. Our primary fuel usage is to power pickup trucks, on-farm implements, and manure application vehicles; (now) natural gas maintains the critical temperature for the anaerobic digesters when the methane powered engines shut down.

Calculation constants:

CO₂ produced by each gallon of:
 propane = 5.52 kg;
 unleaded gasoline = 8.87 kg;
 diesel and fuel oil = 10.15 kg;

natural gas/therm = 5.302 kg.

One common way to standardize energy use from different fuels is in terms of the carbon dioxide (CO₂) each produces.

Combined vehicle + dryer usage equated to **4351** metric tons of CO₂ in 2016.

3-Energy Used (EPA: 6.91×10^{-4} metric tons CO₂ / kWh (each kWh = 3.608 kg CO₂))

Each kilowatt hour of electricity used (equivalent to about 3-4 hours of television operation) causes the release of 1.6 pounds of carbon dioxide into the air. A small house can easily consume 1,000 kilowatt hours of electricity per month, thus releasing 1,600 pounds (0.727 metric tons) of carbon dioxide in the process.

Irish Dairy's 2016 electrical usage equates to **1881** metric tons of carbon dioxide.
Elm Dairy's 2016 electrical usage equates to **2954** " " " "
(more cows, a calf raising endeavor and manure application enterprise).

2016 total electricity used equates to =**4835** metric tons of CO₂
2016 total vehicle fuel and dryer use equals +**4351** " " "

Total fossil fuel use equates to 9,186 metric tons of CO₂

4-Electricity Produced and Carbon Footprint Reduced

Combined excess electricity in 2016 = 4,253,682 kwh which equals : **2939.3** metric tons of CO₂

Since electricity produced by cow's methane earns a multiplier of **23**:

Total 2016 CO₂ methane conversion credit = 67,604* metric tons

*this calculated number is consistent with all our previous reporting, which is based on Wisconsin Public Service's reporting of kilowatt hours used and produced.

*****58,418 metric tons net calculated (CO₂) carbon credit*****

---End---